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Non-native language proficiency may influence the responsiveness of bilingual parents towards young children with autism: A short report

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Abstract

Background and aims: Although bilingualism is a common worldwide phenomenon, limited research has considered the experiences of children with autism growing up in bilingual environments. Here, we investigated the potential influence of parental bilingualism, and native vs. non-native language use, on responsiveness to children's communication attempts during parent–child interactions where the child had autism. Specifically, we investigated the amount of parent responses to child verbal communication (*frequency*) and the promptness of these responses (*temporal synchrony*).

Methods: Participants were 22 monolingual and 20 bilingual parents and their children with autism aged 2–6 years, recruited from a multicultural, metropolitan city where English is the dominant language. Extending from our previous report on this sample, we identified the frequency and temporal synchrony of parent responses from filmed 10-minute free-play sessions. Monolingual parents were videoed during one free-play session in English. Bilingual parents were videoed during two free-play sessions; one in their native language and one in English. We compared the frequency and temporal synchrony of parental responses across monolingual and bilingual parent groups and, for bilingual parents, across native vs. non-native (English) language interaction samples. Finally, we examined how other measures of bilingual parents' non-native language proficiency were associated with interaction responsiveness measures.

Results: When using their native language, bilingual parents demonstrated reduced frequency of responsiveness (even when controlling for opportunities provided by the child) and less temporal synchrony to child communication compared to English-speaking monolingual parents. Bilingual parents were also less frequently responsive (but not less temporally synchronous) during their native- compared to during their non-native (English) language interactions. Moreover, for bilingual parents, more frequent responsiveness to child communication bids when interacting in non-native English was associated with greater assessed English vocabulary knowledge.

Conclusions: In this sample, use of non-native English did not appear to adversely affect how often, or how quickly, bilingual parents responded to their children's verbal communication bids. However, nor did we find evidence of a native-language advantage. Rather, during English-language interactions, when these bilingual parents were responsive towards their children, this was on par with rates and timing of responsiveness shown by English-speaking monolinguals. This may partly be explained by bilinguals' non-native language proficiency, and habitual use/personal dominance patterns.

Implications: These data suggest no definitive drawback of non-native language use for synchronous responsiveness by bilingual parents interacting with young children with autism. However, our data also serve to highlight the complex, multifaceted nature of adult bilingualism, and indicate the need for more research – with large, well-characterised

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samples – to permit strong conclusions concerning how parental language-use choices may influence children's natural learning environments, including in the context of autism and developmental language impairments.

Keywords
Bilingualism, autism spectrum disorders, parents, interaction

Introduction

An emerging empirical literature is focusing on outcomes for children with autism spectrum disorder (hereafter, *autism*) growing up in bilingual environments (Dai, Burke, Naigles, Eigsti, & Fein, 2018; Ohashi et al., 2012). Apprehensions that bilingual exposure may be detrimental for children with autism have been reported by parents and professionals (Hambly & Fombonne, 2012; Kay-Raining Bird, Lamond, & Holden, 2012; Yu, 2013), but these concerns are not supported by empirical data, which show no differences between monolingual- and bilingual-exposed children on measures of language, cognition and autism symptomatology (Hambly & Fombonne, 2012; Ohashi et al., 2012; Valicenti-McDermott et al., 2013). Furthermore, professional bodies – the American Speech-Language-Hearing Association and UK Royal College of Speech and Language Therapists (RCSLT) – advocate that families maintain heritage languages with children with autism (see RCSLT Specific Interest Group in Bilingualism, 2007; Yu, 2018).

Nevertheless, parents frequently report being advised to restrict exposure to one language for children with autism and related conditions (Kay-Raining Bird et al., 2012; Paradis, Krithika, & Keren, 2018; Yu, 2013), with the recommended language often the non-native, community-dominant language (Paradis et al., 2018; Park, 2014). Reciprocal communication between parents and children may be disrupted by the social-communication difficulties associated with early childhood autism (Adamson, Bakeman, Deckner, & Brooke Nelson, 2012; Doussard-Roosevelt, Joe, Bazhenova, & Porges, 2003; Hudry et al., 2013), and advising parents to communicate in a non-native or non-dominant language may have a compounding effect. Empirical research on bilingualism and autism needs to consider whether and how features of parent–child interaction may be affected by parental bilingualism and the use of native vs. non-native languages.

Parent–child interaction and the importance of synchrony

Parent–child interaction has been investigated extensively within both clinical and community samples, including consideration of discrete features such as mutual contingency, reciprocity and language scaffolding (Ciciolla, Gerstein, & Crnic, 2014; Harrist & Waugh, 2002) and more global constructs such as parental responsiveness and synchrony (Eshel, Daelmans, Cabral de Mello, & Martines, 2006; Feldman, 2007). *Synchrony* is a global construct considered to be developmentally important and often included in research on parent–child interaction (see Leclère et al., 2014 for review). However, its operationalisation varies widely between empirical studies. Synchrony may be considered in terms of dyadic coordination of specific behaviours (e.g. social gaze; Harel, Gordon, Geva, & Feldman, 2011), or in terms of the broad temporal relation between adult and child behaviours (i.e. the time it takes for the adult to respond to the child; Gogate, 2010). In our own previous work, (e.g. Hudry et al., 2013; Hudry, Rumney, Pitt, Barbaro, & Vivanti, 2018), we have used the term synchrony specifically in the context of appraising parental communication behaviours that follow responsively from child communication acts, as opposed to asynchronous acts whereby parental communication serves to negate or redirect child behaviour.

Across studies adopting various operationalisations of this construct, parent–child interactions characterised as more synchronous have been found to be associated with better developmental outcomes for children (Harrist & Waugh, 2002; Isabella & Belsky, 1991). For example, in both clinical and community samples, greater dyadic synchrony has been associated with greater cognitive abilities (Kirsh, Crnic, & Greenberg, 1995; Thompson & Trevathan, 2009), adaptive functioning (Healey, Gopin, Grossman, Campbell, & Halperin, 2010) and language skills for children (Matatyaho & Gogate, 2008; Skuban, Shaw, Gardner, Supplee, & Nichols, 2006b), and better quality dyadic attachment relationships (Lundy, 2002). In research on childhood autism, increases in synchronous parental behaviours have been associated with child joint attention and language skills (Siller & Sigman, 2002, 2008). Further, synchronous parental behaviours have been shown to improve child communication outcomes (Green et al., 2010; Pickles et al., 2016) – a key area of difficulty for many children with this condition.

Also well-documented in the early childhood autism literature, is the observation that parent–child interaction can be *asynchronous*. For instance, *reduced* parent responsivity, coordination, communication and emotional expression have been observed during the interactions of parents with their children with autism, aged 4–14 years, particularly as core symptom severity is more pronounced (Beurkens, Hobson, & Hobson, 2013). Asynchronous parental interactions with children with autism likely arise from social-communication difficulties inherent to the condition (Doussard-Roosevelt et al., 2003; Hudry et al., 2013; Wan et al., 2012). For example, compared to toddlers who are typically-developing or have Down syndrome, toddlers with autism have been shown to spend less time jointly-engaged with their parents during semi-structured interactions (Adamson et al., 2012). Preschoolers with autism have also been shown to respond less contingently to their mothers' social approaches, including shifting focus away from or ignoring communication bids (Doussard-Roosevelt et al., 2003). Whilst intrinsic social-communication difficulties may contribute to altering dyadic synchrony in the context of early childhood autism, various factors plausibly contribute (see Bonaminio, Carratelli, & Di Renzo, 1983; Feldman, 2007; Skuban, Shaw, Gardner, Supplee, & Nichols, 2006a; Trevarthen & Daniel, 2005). Consequently, achieving a solid understanding of the causes and consequences of altered social learning environments is a clear objective for the field.

Synchrony in the context of parental bilingualism

Returning to the context of parental bilingualism, if parents follow advice to restrict exposure to one language and adopt the community-dominant (i.e. their non-native) language for interaction with their child, there is clear potential for a compounding effect on child development through altered synchrony. Qualitative research accounts have raised this possibility. For instance, bilingual parents who have been encouraged to use English during interactions with their children, rather than their dominant language, have reported feeling conversations were less personal (Yu, 2013), and experiencing difficulties expressing affect, thereby altering the experience of emotional connection (Wharton, Levine, & Miller, 2000). Moreover, if additional language processing is required to communicate in a non-dominant language, it may be more difficult for bilingual parents to be responsive to their children's own attempts to communicate (Altan & Hoff, 2018). This assertion may be particularly true for *sequential bilinguals* (i.e. those who have learned their second language after their first) who have been found to have slower language processing and poorer grammatical proficiency in their second language (Lew-Williams & Fernald, 2010).

We recently published the first empirical study to examine whether parental bilingualism, and/or native vs. non-native language use, might influence interaction with young children with autism. We recruited a sample of 22 monolingual and 20 bilingual parents from community settings in a metropolitan city where English is the community-dominant language (Hudry et al., 2018). From video-taped free-play interaction samples – including two samples for bilingual parents (i.e. one using their native language and one using non-native English) – we classified each parent communicative utterance as *synchronous* or *asynchronous* in terms of content (i.e. synchronous acts were those that followed the child's focus, whereas asynchronous acts were those that redirected the child's attention, negated or elicited a response from the child). We then computed the proportion of parent utterances that were *synchronous*, and found bilingual parents to be relatively less synchronous than monolingual parents, but with no significant difference in synchrony across their native and non-native language interaction samples. Clear variability was apparent in bilingual parents' interaction behaviours, and in their proficiency of non-native English-language knowledge and self-reported comfort interacting with their child using this language. English-language knowledge and self-reported comfort ratings were associated – that is, parents with better English vocabulary knowledge reported greater comfort with English-language interaction – and both of these factors were also moderately positively correlated with proportionate synchrony ($r = .30$–$.35$ but statistically non-significant with this sample).

While bilingualism affords many widely-acknowledged benefits (Kroll & Dussias, 2017), adults who learn another language later in life, or who are less proficient in use of a given language, can process language more slowly and less accurately than native speakers (Weber-Fox & Neville, 1999). Feldman (2007) defines synchrony specifically as "*the temporal coordination of micro-level social behaviour*" (p. 340) and the extra processing time required when using a non-native language may impact the efficiency and automaticity of exchanges (Altan & Hoff, 2018; Birdsong, 2004). Within parent–child interaction, this means non-native language use could see bilingual parents struggle to be temporally responsive to their children's communication attempts, potentially compounding the interaction difficulties experienced by their young children with autism who may be less contingently responsive to their parents' social approaches (Doussard-Roosevelt et al., 2003). Taken together, limited child communication bids, reduced efficiency of

parent responses, increased effort to process and respond to linguistic information, and reduced child contingency may result in fewer, less synchronous exchanges between bilingual parents and their young children with autism, when a parent is interacting in a non-native vs. native language.

Current study

We extended from our recent study to more closely examine parental responsiveness in the context of adult bilingualism and childhood autism. Here we considered the *frequency* and *temporal synchrony* of parental responsiveness to child verbal communication acts (i.e. any vocalisation or verbalisation made by the child) across free-play interaction samples collected for monolingual and bilingual parents, and including both native languages (L1) and non-native English (L2) samples for the latter group. In our earlier study, while we observed similar frequencies of relative synchrony in bilingual parents' native and non-native language interactions – in terms of responses that followed the child's focus of attention/behaviour (Hudry et al., 2018) – due to the additional processing time required to communicate using a non-native language, we hypothesised here that bilingual parents might have reduced frequency of responsiveness to child verbal communication and greater latency of response time (i.e. reduced *temporal synchrony*) during interaction in L2 (English) compared to (i) during interaction in L1, and (ii) monolingual parents interacting in their only language (here, English). Further, given the variability in L2 proficiency observed in our previous study with this participant sample, we hypothesised that factors such as L2 competence (assessed English vocabulary knowledge), self-reported comfort interacting in L2, and retained use of L1 vs. habitual adopted use of L2 in the family home might be associated with the *frequency* and/or *temporal synchrony* of parent responsiveness during interaction in this language with their young children with autism.

Methods

Participants

Participants here were the same parent–child dyads we have recently described (Hudry et al., 2018), recruited from community settings in Melbourne, Australia. Participating children were aged 2–6 years and all diagnosed with an Autism Spectrum Disorder. Two of the children were preverbal. There were no significant differences in age or sex ratio between children whose parents were Monolingual ($M = 50.27$ months, $SD = 10.25$; 72.7% male) or Bilingual ($M = 52.85$, $SD = 16.10$; 65% male), nor in terms of autism symptom severity or non-verbal developmental abilities (see Hudry et al., 2018). Most families (95.2%) reported current regular, but infrequent, participation in English-language early intervention services (i.e. speech pathology, occupational therapy, music therapy, psychology, applied behaviour analysis).

Participating parents were recruited into one of two groups. Monolingual parents ($n = 22$) were all speakers of English and reported originating from countries where English was the native language (e.g. Australia, New Zealand), with no significant exposure to languages other than English. They were mothers ($n = 18$) or fathers of the participating children, aged 31–45 years, and highly educated (86% tertiary degree).

Bilingual parents ($n = 20$), aged 31–48 years, were also mostly mothers of the participating children ($n = 16$; three fathers; one grandmother aged 71 years). All had English as L2 with varied L1 – including Mandarin ($n = 3$), Greek ($n = 3$), Mandarin/Cantonese ($n = 2$), Indonesian ($n = 2$), Italian ($n = 2$), Punjabi ($n = 1$), Filipino ($n = 1$), Tamil ($n = 1$), Afrikaans ($n = 1$) and German ($n = 1$). Three parents were trilingual; one parent spoke Spanish, Urdu and English and two parents spoke Mandarin, Cantonese and English. All Bilingual parents were Australian residents but most (80%) reported having been raised in the country of their native language, emigrating to Australia between 1 and 26 years prior to study participation. Similarly, most Bilingual parents (80%) reported learning English sequentially after L1, though four parents reported simultaneous English and native language acquisition but still described English as their second language. Again, this group of parents was highly educated (94.7% tertiary degree). At the time of study participation, around half of Bilingual parents (55%) reported predominant use of L2 (English) when talking to their children with autism at home, while 20% reported predominant use of L1 and 25% reported fairly balanced use of both L2 (English) and L1.

Procedure and measures

Approval for this study was provided by the La Trobe University Human Ethics committee (Ref. 11-064). As detailed by Hudry et al. (2018), parent–child dyads were seen for assessment at a clinic/lab setting, or at home. Assessments included administration of standardised measures of child autism symptoms and developmental abilities. The Expressive One Word Picture Vocabulary Test Fourth Edition (EOWPVT-4; Martin & Brownell, 2011) was also administered to Bilingual parents as a measure of basic L2 proficiency, and also to Monolingual parents as an assessment of L1. The brief EOWPVT-4 was chosen to assess

parents' language ability as vocabulary lays the foundation for proficiency in second language learning (Milton, 2009). No standardised assessment of bilingual parents' LI proficiency was administered. Dyads were filmed during 10-minute unstructured free-play; one sample for Monolingual and two for Bilingual parents (one in each of L1 and L2, order counterbalanced). Following each interaction sample, the parent was asked "How comfortable did you feel playing in [language] just now?" on a 7-point scale from 1 = not comfortable to 7 = very comfortable.

Parent–child interaction coding

For the current study, the interaction footage and associated written translation/transcripts (see Hudry et al., 2018) were coded specifically for parent responsiveness to child verbal communication acts. Trained volunteer coders – three undergraduate psychology students kept naïve to the study design and hypotheses – were assigned a sample of videos including both Monolingual and Bilingual participants (but with no coder viewing *both* the L1 and L2 interactions of a Bilingual participant). English-language transcripts were provided alongside the English-language interaction footage, and English-translated transcripts were provided alongside Bilinguals' L1 interaction samples, with target vocalisations highlighted.

The videos and translation/transcripts were used together to code parent responsiveness towards child communication acts. First, verbal interaction events – that is, (i) child vocalisation, followed by (ii) parent response related to the child's vocalisation (i.e. response not redirecting the child to a new topic of the parent's choosing) – were identified (see Siller & Sigman, 2008 for further information). Observer XT (Noldus, 2008) was then used to code the *temporal synchrony* of these responsive parental acts. Child-initiated vocalisations were time-stamped midway through the utterance and parent responses were time-stamped at their initiation, with the latency-to-respond calculated. Two key measures were retained per dyad for analysis: the total number of verbal interaction events and the mean latency of parent response to child communication acts, hereafter referred to, respectively, as the *frequency* and *temporal synchrony* of parental responsiveness. As it was a straightforward addition of events, no inter-rater reliability check was conducted on the frequency of parent responsiveness. However, a fourth coder was engaged to conduct checks on inter-rater agreement for *temporal synchrony*, independently coding ~40% of the interaction samples selected at random (but balanced across the three principal coders). Excellent agreement was observed across the mean *temporal synchrony* data for 24 tapes; $r = .93$.

In addition to the parent responsiveness measures, transcripts were also used to collect two child language measures for inclusion as covariates in the analysis of *frequency* and *temporal synchrony*, respectively: number of child vocalisations/verbalisations (hereafter, child utterances), and mean length of utterance (MLU). Both measures were generated from transcripts using Systematic Analysis of Language Transcripts (SALT) software (Miller, Andriacchi, & Nockerts, 2011). For the two preverbal children, MLU was recorded as zero as no morphemes were used.

Results

After controlling for child utterances, *frequency* of parental responsiveness was greater in Monolingual interactions ($M = 26.73$, $SD = 10.97$) compared to Bilingual interactions in L1 ($M = 16.10$, $SD = 7.17$; $F(1,39) = 7.96$, $p = .007$, $\eta_p^2 = .169$), but not those in L2 English ($M = 18.35$, $SD = 11.18$; $F(1,39) = 1.02$, $p = .318$, $\eta_p^2 = .026$). The covariate, child utterances – a proxy measure for opportunities provided by the child – was statistically significant in both cases ($F(1,39) > 37.19$, $p < .001$, $\eta_p^2 > .487$). Bilingual parents responded more frequently in L2 English than in their L1 interactions ($F(1,18) = 4.59$, $p = .046$, $\eta_p^2 = .203$), controlling for child utterances which was again a significant covariate ($F(1,18) = 10.74$, $p = .004$, $\eta_p^2 = .374$). Figure 1 shows these between- and within-group comparisons, and also the substantial spread of scores within groups/conditions. Visual representation of individual Bilingual parents' *frequency* of responsiveness when interacting in L1 vs. L2 is also shown, reflecting moderate within-participant association ($r_p = .51$, $p = .022$).

Similarly, Monolingual parents had reduced latency of responsiveness in seconds – that is, greater *temporal synchrony* – to child communication acts ($M = 1.62$, $SD = 0.38$), compared to Bilingual parents interacting in L1 ($M = 2.43$, $SD = 1.21$; $F(1,39) = 11.15$, $p = .002$, $\eta_p^2 = .222$), after controlling for child MLU (a proxy measure for the temporal length of the preceding child utterance which was not a significant covariate; $F(1,39) = 2.14$, $p = .152$, $\eta_p = .052$). There was no significant difference, however, in the mean temporal synchrony of Monolingual parents and Bilingual parents when interacting in L2 English ($M = 1.68$, $SD = 0.57$; $F(1,39) = 1.02$, $p = .318$, $\eta_p^2 = .026$), where child MLU was a significant covariate ($F(1,39) = 5.88$, $p = .020$ $\eta_p^2 = .131$). The difference in temporal synchrony when Bilinguals interacted in L1 vs. L2 English was also not statistically significant, after controlling for child MLU ($F(1,18) = 1.28$, $p = .272$, $\eta_p^2 = .066$), with the latter again a non-significant covariate ($F(1,18) = 0.16$, $p = .900$ $\eta_p^2 = .001$).

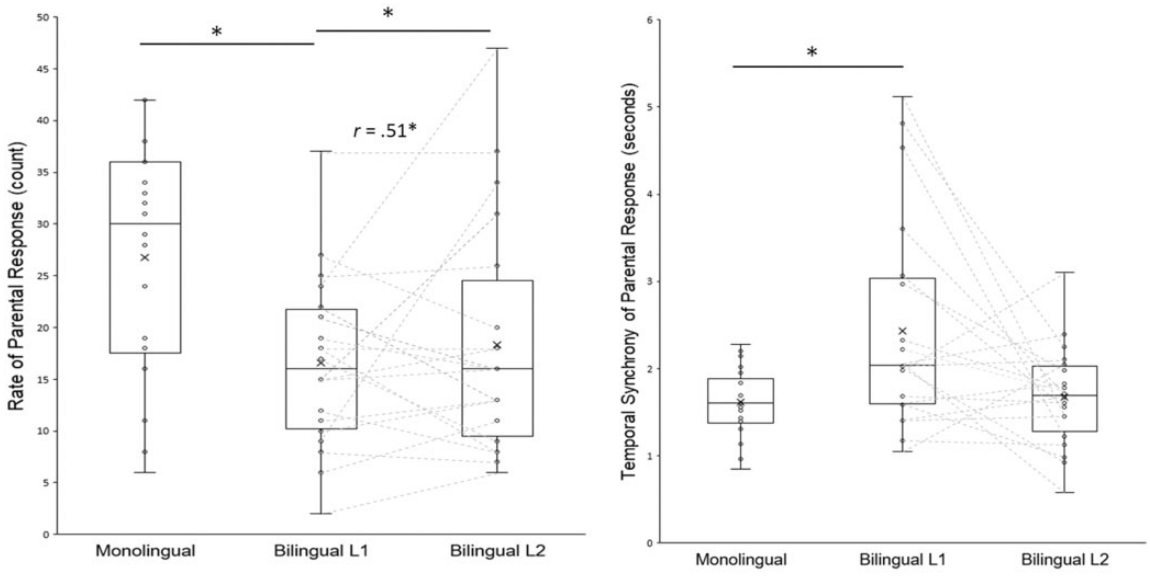

Figure 1. Box Plots showing (i) *frequency* and (ii) *temporal synchrony* of parental responsiveness during interaction with their young children with autism, by Monolingual and Bilingual parents, including in L1 (native language) and L2 (non-native English) for the latter group. The observed spread of scores within groups/conditions reflects substantial between-participant variability, as does the pattern of lines mapping Bilingual parents' corresponding L1–L2 data-points.

Figure 1 also shows these between- and within-group comparisons. Here, no association presented between individual Bilingual parents' *temporal synchrony* when interacting in L1 vs. L2 ($r_p = .04$, $p = .869$), with substantial variation in individual Bilingual parents' latencies to respond when interacting in one or other language. That is, some parents had greater latency to respond when interacting in L2 English, while others showed more balanced response latency across their languages, and others showed *more rapid* response in L2.

Associations with indicators of non-native language proficiency

As we have previously reported (Hudry et al., 2018), Monolingual parents demonstrated greater proficiency in English (as their only language; EOWPVT-4 Standard Score [SS] $M = 98.32$; $SD = 13.15$) than did Bilingual parents (L2; $M = 72.15$; $SD = 18.82$; $t(40) = 5.26$, $p < .001$, $d = 1.61$). That is, English vocabulary knowledge of Monolinguals was broadly as expected according to EOWPVT-4 norms, whereas that of Bilinguals was nearly two standard deviations below the population mean. However, while all Bilingual parents were recruited on the basis of identifying English as L2, around half reported predominant use of this language at home with their children by the time of study participation ($n = 11$), with the remainder ($n = 9$) reporting either predominant use of L1 or balanced L1–L2 use.

Further, we have previously reported significantly higher comfort ratings by Monolinguals (i.e. following their English-language interaction: $M = 5.91$, $SD = 1.44$) compared to comfort ratings by Bilinguals following their L1 interaction ($M = 4.85$, $SD = 1.87$; $z = 2.07$, $p = .039$, $d = .64$), with Bilinguals' comfort ratings following L2 English-language interactions ($M = 5.40$, $SD = 1.50$) intermediate and not significantly different to either of these (Hudry et al., 2018). Given the variability across various indices of non-native language proficiency evident within our Bilingual participant sample, we examined associations among parents' assessed English-language vocabulary knowledge, and self-reported interaction comfort ratings, with our measures of parental responsiveness, and also compared *frequency* and *temporal synchrony* of parent responsiveness in the two 'habitual language use' subgroups suggested within our Bilingual sample.

Among Monolingual parents, and controlling for the variance explained by child utterances/MLU, there was no significant association between EOWPVT-4 SS as a measure of (L1) English-language proficiency and *frequency* ($r_p = -.10$, $p = .654$) or *temporal synchrony* ($r_p = -.39$, $p = .082$) of parental responsiveness (although the later approached statistical significance). For Bilingual parents, however, there was a strong positive association between English-language proficiency and the *frequency* of parental responsiveness during L2 interactions ($r_p = .50$, $p = .028$), though not with

temporal synchrony ($r_p = .06$, $p = .796$), again controlling for child utterances/MLU.

When comparing 'habitual use' Bilingual subgroups for responsiveness during L2 interactions, those reporting predominant English use at home showed higher frequency of responses ($M = 22.64$, $SD = 12.54$) compared to those reporting predominantly L1 or balanced L1–L2 use ($M = 13.11$, $SD = 6.64$); however, this difference was not statistically significant when controlling for frequency of child utterances ($F(1,17) = 1.07$, $p = .315$, $\eta_p^2 = .059$) which was a significant covariate ($F(1,17) = 15.94$, $p = .001$, $\eta_p^2 = .484$). There was no effect of habitual language use apparent for *temporal synchrony* in L2 English ($F(1,17) = .002$, $p = .966$, $\eta_p^2 = .000$) or L1 interactions ($F(1,17) = 1.72$, $p = .207$, $\eta_p^2 = .092$).

Regarding self-reported comfort ratings, and again controlling for child utterances/MLU, no significant associations were evident with parental responsiveness measures among the Bilingual group – whether within L1 interaction (*frequency*, $r_p = .13$, $p = .609$; *temporal synchrony*, $r_p = .19$, $p = .449$) or L2 English-language interactions (*frequency*, $r_p = .30$, $p = .208$; *temporal synchrony*, $r_p = .05$, $p = .852$) – nor among the Monolingual group (*frequency*, $r_p = .28$, $p = .218$; *temporal synchrony*, $r_p = .01$, $p = .959$).

Discussion

Following our recently published study examining the potential influence of bilingualism – and specific native vs. non-native language use – on parental communicative interaction behaviours with young children with autism (Hudry et al., 2018), here we specifically examined the *frequency* and *temporal synchrony* of parental responsiveness to child verbal communication acts. Contrary to our hypotheses, when interacting in their native languages, but not when using L2 English, bilingual parents demonstrated significantly reduced frequency and increased temporal latency of responsiveness compared to monolingual parents (controlling for child utterance rate as an indicator of responsiveness opportunities available to the parent). Also counter to our hypothesis, and again controlling for child utterances, the frequency of responsiveness by bilingual parents was higher when interacting in non-native English compared to the native language. Further, Figure 1 demonstrates that whilst frequency of responsiveness was moderately strongly associated across bilingual parents' native- and non-native language samples (i.e. such that those with greater *frequency* of responsiveness in one context also tended to show greater responsiveness in the other), no such stability of bilingual parents' *temporal synchrony* across language-use contexts was apparent. That is, while bilingual parents as a group were slower to respond when interacting in L1 than were monolingual parents, some bilingual individuals showed more rapid responsiveness in one language and slower responsiveness in the other, and vice versa.

From our previous analysis of this participant sample, we knew that the bilingual parents had significantly reduced proficiency with non-native English than did their monolingual native-speaking counterparts – evidenced through simple assessment of vocabulary knowledge – but that their self-reported comfort ratings seemed somewhat higher following English- vs. native-language interaction samples (Hudry et al., 2018). We also suspected that our heterogeneous 'bilingual' group might in fact comprise subgroups of parents with greater/lesser proficiency of native- vs. community-dominant English language use during everyday home interactions. Indeed, around half of bilingual parents reported predominant use of English at home by the time of their study participation, while others reported ongoing predominant native-language use, or balanced dual-language use. We therefore conducted additional investigation of potential associations of parental responsiveness measures taken from the filmed interaction samples with these various indicators of potential non-native English language proficiency.

For Bilinguals, no associations were apparent between self-reported comfort ratings or predominant use of this language at home with either measure of parental responsiveness – frequency or temporal synchrony – in either L1 or L2 interaction. There was a strong positive association between Bilinguals' L2 English vocabulary knowledge and *frequency* – but not temporal synchrony – of parental responsiveness when interacting in this language. These exploratory findings suggest that parental responsiveness to child communication acts – in the context of bilingualism and autism – may be more closely linked to the extent of proficiency of a non-native language, or cultural features that come with interaction grounded in English-language use, rather than bilingual status or native/second language status, per se.

Non-native language proficiency

Our complex pattern of findings – concerning frequency and temporal synchrony of responsiveness across groups of monolingual vs. bilingual parents, and specific to native vs. non-native language use – were broadly counter to our hypotheses that favoured a native language advantage (Birdsong, 2004; Wharton et al., 2000). However, the demonstration of bilingual parents with smaller English-language vocabularies showing reduced frequency of responsiveness highlights that features of non-native language proficiency are important to consider in appraising bilingual

interactions (Grosjean, 1998). When parents have better non-native language proficiency, responsiveness to child communication attempts may be greater (Altan & Hoff, 2018; Weber-Fox & Neville, 1999).

Our current findings do, however, align with those from our previous report on this same participant sample, including similar balance of synchronous/asynchronous contributions across bilingual parents' native/non-native-language interactions (and reduced overall compared to monolingual parents' contributions; Hudry et al., 2018). Language demands are known to vary with interactional contexts (Anderson, Mak, Keyvani Chahi, & Bialystok, 2017; Green & Abutalebi, 2013) and language dominance for bilingual adults is not static, but varies within-individuals across interaction contexts and linguistic domains (Birdsong, 2018). Despite the fact that our bilingual participants had all nominated English as their non-native language, the majority reported frequent use of English at home by the time of study participation. So, while English may strictly represent our participants' non-native language, this may have become the personal *dominant* language for many bilingual individuals for everyday interaction with their children.

Cultural differences in parental responsiveness

Reduced average *temporal synchrony* was only apparent for bilingual parents' native-language interactions, not during interactions in English. Moreover, substantial within-group variability was evident in the average latency to respond, and there was a striking *lack* of association between individuals' temporal synchrony shown in interaction using one vs. other language. While this heterogeneity of effects may point again to the issue of individuals' personal language dominance, this may also reflect variation in participants' cultural/ethnic backgrounds in the context of a shared experience of residing in a country where English is the community-dominant language. Language and culture are intrinsically interwoven (Genc & Bada, 2005) and while a responsive style of 'child-led' parenting is valued within English-speaking societies (Eshel et al., 2006; Vigil, 2002; Washbrook, Waldfogel, Bradbury, Corak, & Ghanghro, 2012), a more directive approach is typical in many other cultures (Simmons & Johnston, 2007; Vigil & Hwa-Froelich, 2004).

More rapid *temporal synchrony* of bilingual parents interacting in *non-native English* could also be associated with participants' contemporaneous involvement with intervention services delivered in English; along with evidence of bilingual parents responding more frequently to their child's communication during English-language interactions (effect present even when controlling for opportunities provided by the child). Most parents reported engagement with local community services; most commonly, with speech pathology providers. While we did not collect data on the specific therapeutic activities these families engaged in with their community service providers, typical speech pathology strategies promoted in the preschool years – the age range of the current study – include promoting parental responsiveness to child communication attempts (Roberts & Kaiser, 2011, 2012; Sealy & Glovinsky, 2016). That bilingual parents responded to child communication attempts more frequently during English- vs. native language interactions – regardless of the opportunities provided by their children – suggests our sample may have had practice or even direct coaching around tuning in and responding to their child's communication during English-language (therapeutic) interaction.

Study limitations and future directions

Although we sought to recruit a sample of bilingual parents with varied native languages, reflecting the local community context, interpretation of our results is complicated by the heterogeneity apparent in this group – including various native languages, and non-native English proficiency and dominance patterns. Our data serve to highlight the complex, multifaceted nature of adult bilingualism, pointing to the need for future research to recruit large samples and to comprehensively characterise individuals' current language proficiency and dominance, as well as the timing and patterns of second-language acquisition which have been found to moderate these factors (Kim, Relkin, Lee, & Hirsch, 1997). Whilst heterogeneous in terms of language status, our sample was otherwise quite homogeneous in terms of education level/socio-economic status. As associations between synchronous parenting and child outcomes have been found to vary by socioeconomic status (as well as by culture and ethnicity, as discussed above) (HoffGinsborg, 1991, 1998; Shimpi, Fedewa, & Hans, 2012; Vigil & Hwa-Froelich, 2004), future studies should seek to more representatively sample family socio-demographic factors, including parents' language of schooling and university instruction (Laosa, 1982). Additionally, measuring parents' native *and* non-native proficiency – across language domains and interaction contexts – would further elucidate the contributions that native and non-native language competence and experience play in parent–child interaction for children with autism. Furthermore, as developmental outcomes vary depending on whether language is directed toward the child – as opposed to other adult-directed or overheard speech (Weisleder & Fernald, 2013) – future studies should attempt to capture the amount of

child-directed speech in the various languages to which the child is exposed at home.

Studies of the impact of altered social learning environments – their causes and consequences – necessarily beg the question of demonstrable outcomes for children. Future research with this cohort, and on this topic, would benefit from the concurrent and prospective evaluation of child contributions and outcomes to understand the potential longer-term impacts of parent dual-language input, or non-native language use. For example, future consideration is warranted of the role that other child characteristics (i.e. autism symptomatology) play in responsiveness for monolingual and bilingual parents – across different cultures and ethnicities. In the context of outcomes for children with autism and associated conditions, the collection of comprehensive family service use data – particularly knowledge of previous *parent-implemented* early interventions – would also permit inferences to be drawn about the extent to which observed parenting behaviours might arise in response to strategies taught by service providers, rather than as natural parental responses to child behaviours in the context of social/cultural traditions around parent–child interaction.

Summary and conclusion

Expanding from our recent study showing bilingual parents to be less synchronous than monolingual parents in the focus of their communication acts with their children with autism (Hudry et al., 2018), here we undertook a closer examination of parental responsiveness to child verbal communication acts, identifying the frequency of parent responses and the temporal synchrony of these. While we found no adverse effect of non-native language interaction for temporal synchrony within the interactions of bilingual parents and their young children with autism, nor did we find evidence of any native language advantage. Rather, bilingual parents showed a reduced frequency of responsiveness and reduced temporal synchrony when interacting in their native language, compared to English-speaking monolinguals. Moreover, bilingual parents showed an increased frequency of responses when interacting in non-native English compared to during native language interactions. Substantial heterogeneity in non-native English proficiency was evident which may contribute to our observed effects. In light of the complex, multifaceted nature of adult bilingualism – and including the likely roles of culture and previous intervention receipt on parent–child interaction behaviour – future research with large, well-characterised parent–child dyads is required to understand to what extent and how the language used by parents may influence the everyday learning and developmental experiences of young children, including those with autism and associated conditions.

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